



## Unit 3

# Reducing Risks From Winds

*Objectives: At the end of this unit, participants will be able to:*

- 1. Describe the steps the homeowner can take to reduce vulnerability to high winds, tornadoes, and hurricanes.*
- 2. Identify the four areas of the home that should be checked first for weakness before a hurricane or tornado strikes.*
- 3. List three non-structural pre-hurricane/tornado mitigation tips that will reduce damage to the home.*

## INTRODUCTION

Wind is a major source of fatalities and property losses in the United States. From 1981 to 1990, insured losses from wind damage totaled \$23 billion. Two main sources of wind-related loss of life and property damage are **tornadoes** and **hurricanes**.

### *Hurricanes*

One of the most dramatic, damaging, and potentially deadly events that occur in this country is a hurricane. If you live in a Gulf, or Atlantic coastal state, you are in a hurricane zone. Few communities within this zone remain untouched by the killer storms that occur from June 1 through November 30.

Hurricanes are products of the tropical ocean and atmosphere. Powered by heat from the sea, they are steered erratically by the easterly trade winds and the temperate westerly winds, as well as by their own energy. As they move ashore, they bring with them a storm surge of ocean water along the coastline, high winds, tornadoes, and both torrential rains and flooding. Each year on average, ten tropical storms develop over the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico. About six of these will strengthen enough to become hurricanes. Many of these remain over the ocean with little or no impact on the continental United States. However, about five hurricanes strike the United States coastline every 3 years. Of these five, two will be major hurricanes measuring a category 3 or higher (defined as having winds above 111 miles per hour) on the Saffir-Simpson

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Scale. These storms can end up costing our nation millions, if not billions, of dollars in damages.

The **Saffir-Simpson** Scale breaks them into the following categories according to wind speeds:

Category 1: 74 - 95 miles per hour

Category 2: 96 – 110 mph

Category 3: 111 – 130 mph

Category 4: 131 – 155 mph

Category 5: greater than 155 mph

**Category One and Two** hurricanes usually pose minor damage to stable building structures, but can do major damage to mobile homes, vegetation and piers. These categories cause flooding in some coastal areas.

**Category Three** hurricanes cause some structural damage to small residences and utility buildings. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet above sea level may be flooded inland 8 miles or more.



**Category Four and Five** hurricanes are the most deadly and destructive. Both can create roof failure and building collapse.

During a hurricane, homes, businesses, public buildings, and infrastructure may be damaged or destroyed by high winds and high waves. Debris can break windows and doors, allowing high winds and rain inside the home. Roads and bridges can be washed away by flash flooding, or can be blocked by debris. In extreme storms (such as Hurricane Andrew), the force of the wind alone can cause

tremendous devastation, as trees and power lines topple and weak elements of homes and buildings fail. And these losses are not limited to the coastline -- they can extend hundreds of miles inland, under the right conditions. In September of 1989, Hurricane Hugo battered Charlotte, North Carolina, (175 miles inland) with gusts of winds 100 mph, downing trees and power lines and causing massive disruption.

Fortunately, there are a variety of measures that can be taken -- both at the individual and community levels -- to reduce your vulnerability to hurricane hazards. Simple construction measures, such as the use of storm shutters over exposed glass, and the addition of hurricane straps to hold the roof of a structure to its walls and foundation, have proven highly effective in lowering damages when hurricanes strike. In addition, more complex mitigation measures can be

pursued to further reduce a property's susceptibility. For example, coastal homes and businesses can be elevated to permit coastal storm surge to pass under living and working spaces. Communities can further reduce their vulnerability to hurricanes through the adoption and enforcement of wind- and flood-resistant building codes. Sound land-use planning can also ensure that structures are not built in the highest hazard areas.

#### ***Tornadoes***

Although tornadoes occur in many parts of the world, these destructive forces of nature are found most frequently in the United States east of the Rocky Mountains during the spring and summer months. Tornado season is usually March through April, although tornadoes can occur at any time of year. In the southern states, peak tornado occurrence is in March through May, while peak months in the northern states are during the summer. They tend to occur in the afternoons and evenings.



In an average year, 800 tornadoes are reported nationwide, resulting in 80 deaths and over 1,500 injuries. A **tornado** is defined as a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes strike with incredible velocity. The most violent tornadoes are capable of tremendous destruction and wind speeds can approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Once a tornado in Broken Bow, Oklahoma, carried a motel sign 30 miles and dropped it in Arkansas. As the wind intensifies, shingles begin to lift and trees are uprooted. Unprotected doors give way and the wind is inside the house, pushing the structure from within. Poorly attached window coverings give way, and as pressure builds, the garage door fails, allowing the full force of the wind inside. Among other things the wind can rip off sheathing (decking) and destroy gable end walls. Over-hanging eaves and rakes, extended awnings, open porches, and other features that tend to trap air beneath them are particularly susceptible to damage. Wind-borne debris can break windows and damage roof coverings and walls. In fact, these powerful forces can literally lift the roof right off the house. And all this happens in a matter of seconds. Tornadoes are classified using the Fujita Scale below.

### **Fujita Tornado Intensity Scale**

**Category F-0:** 40 – 72 miles per hour. Gale tornado, light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.

**Category F-1:** 73 – 112 mph. Moderate tornado; moderate damage. Peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.

**Category F-2:** 113 – 157 mph. Significant tornado; considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

**Category F-3:** 158 – 206 mph. Severe tornado; severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.

**Category F-4:** 207 – 260 mph. Devastating tornado; devastating damage. Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.

**Category F-5:** 261 – 318 mph. Incredible tornado; incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur.

### ***Watches versus Warnings***

Many people confuse the meaning of a tornado ‘watch’ and tornado “warning” issued by the National Weather Service. Here’s the difference:

**Watch:** tornadoes are possible in your area; remain alert for approaching storms.

**Warning:** A tornado has been sighted or indicated by weather radar. If a tornado warning is issued for your area and the sky becomes threatening, move to your pre-designated place of safety.

## **EXAMPLES OF MITIGATION TECHNIQUES**

Hurricanes and tornadoes both have in common very high winds and the associated damage. Once a tornado or hurricane strikes, there is little to do to prevent damage; however, there are steps you can take ahead of time to protect lives and property. If you aren't sure whether your house is at risk from hurricanes or tornadoes, check with your local building official, city engineer, or

planning and zoning administrator. They can tell you whether you are in an area where these high-wind events occur. Also, they usually can tell you how to protect yourself and your house and property.

In this unit, we will explore the steps you can take to reduce risks to your home during high winds, tornadoes and hurricanes. After Hurricane Andrew, a team of experts examined homes that had failed and ones that had survived. They found four areas that should be checked for weakness—

- the roof,
- windows,
- doors, and
- if you have one, garage door.

We will discuss some steps here that you can take to help make your home stronger before the next windstorm strikes.

While these projects, if done correctly, can make your home safer during a hurricane, they are no guarantee that your home won't be damaged or even destroyed. If you are told by authorities to evacuate, do so immediately, even if you have taken these precautions.

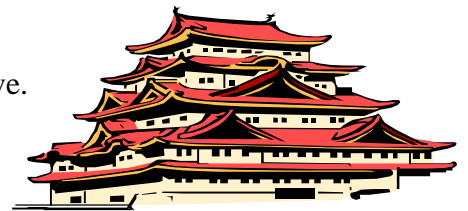
Hurricane and tornado protection can involve a variety of changes to your house and property -- changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county, or city. The examples of hurricane and tornado protection listed below are things that skilled homeowners can probably do on their own.

## ***ROOF STRUCTURES***

During a windstorm, the force of the wind pushes against the outside of your home. That force is passed along from your roof to the exterior walls and finally to the foundation. Homes can be damaged or destroyed when the energy from the wind is not properly transferred to the ground.

*Does your home have a gabled roof?*

The first thing you should do is determine what type of roof you have. Homes with gabled roofs are more likely to suffer damage during a hurricane. A gabled roof looks like an A on the ends, with the outside wall going to the top of the roof. The end wall of a home with a gabled roof takes a beating during a hurricane, and those that are not properly braced can collapse, causing major damage to the roof.

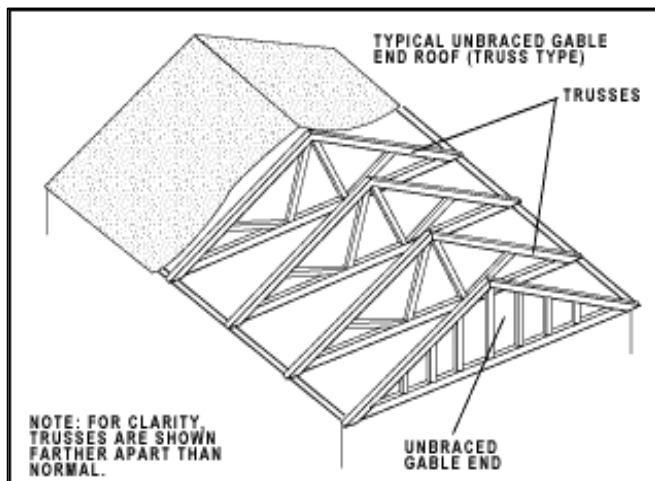


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1. **Inspect roof's bracing.** In most homes, gabled roofs are built using manufactured trusses. Sheets of roof sheathing, often plywood, are fastened to the trusses with nails or staples, and roofing material is fastened to the sheathing. In many cases, the only thing holding the trusses in place is the plywood on top. This may not be enough to hold the roof in place during a hurricane. Installing additional truss bracing makes your roof's truss system much stronger.

To inspect your roof's bracing, go into the attic. While working in your attic, you should wear clothing that covers your skin, work gloves, a hat, eye protection, and a dust mask. If your attic does not have a floor, be careful to walk on the wood joists, or install boards wide enough to walk on as you work. Notice how the plywood is attached to the truss system. If most of the large nails or staples coming through the sheathing have missed the trusses, consider having the sheathing properly installed.

2. **Install Truss bracing.** In gabled roofs, truss bracing usually consists of 2x4s that run the length of the roof. If you do not have truss bracing, it should be installed. You can do this yourself or hire a professional. Install 2x4s the length of your roof, overlapping the ends of the 2x4s across two trusses. Braces should be installed 18 inches from the ridge, in the center span, and at the base, with 8 to 10 feet between the braces. Use two 3-inch, 14-gauge wood screws or two 16d (16 penny) galvanized common nails at each truss. Because space in attics is generally limited, screws may be easier to install.
3. **Brace gable end roof framing.** Another example of hurricane and tornado protection is adding bracing to gable end roof framing. This is something that only a licensed contractor should do.



Gable end roofs are more susceptible to damage by high winds than hip roofs or flat roofs. The gable end presents a large obstacle to the wind and receives its full force. If the framing of the gable end and the rest of the roof are not adequately braced to resist the wind, the roof can fail. Roof failures, especially in unbraced gable roofs, are a common cause of major damage to houses and their contents in high winds.

If your house has a gable roof, you should check to see whether the roof framing is braced. Some gable end roofs are truss roofs, but some are constructed with rafters rather than trusses. Both types should be braced. If you are

unsure whether your gable end roof is adequately braced, check with your local building department. After inspecting your roof framing, a building official can tell you whether bracing is required and if so, how it should be added.

Gable end bracing consists of 2x4s placed in an “X” pattern from the top center of the gable to the bottom center brace of the fourth truss, and from the bottom center of the gable center to the top center brace of the fourth truss. Use two 3-inch, 14-gauge wood screws or two 16d (16 penny) galvanized common nails to attach the 2x4s to the gable and each of the four trusses.



### **Tips**

Keep these points in mind if you have bracing added to a gable end roof:

- Bracing can be added fairly easily, but you should have a contractor perform the work to make sure that the bracing is properly designed and attached.
- If you have a building official inspect your roof framing, ask about other changes you may be able to make to your house to protect it from high winds.

Estimated Cost. If you hire a contractor to brace a gable end roof, you can expect to pay about \$75 for each gable end. This figure is for a gable end about 30 feet long. Bracing longer gable ends may be slightly more expensive.

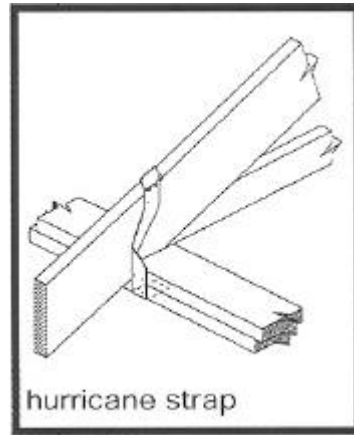
**4. *Install hurricane straps in your home or business to better secure the roof to the walls and foundation.*** This will reduce the risk of losing your roof to high winds. There are many types of roof design. Regardless of your type of roof, hurricane straps are designed to help hold your roof to the walls. While you are in the attic, inspect for hurricane straps of galvanized metal.

To install straps or hurricane clips, remove the roof sheathing around the perimeter of the roof to reveal the top of the wall. You may also need to remove the soffit (the horizontal underside of an eave) and exterior cladding to reveal the top 12 to 18 inches of the wall. In addition, if the exterior cladding is brick veneer, you may need to remove small sections of brick as needed.

If your roof has trusses, make sure you tie them to the wall by either anchoring to the top plate and then the top plate to the wall stud, or strapping the truss directly to the wall stud. You can anchor the roof to the top of the wall of wood or masonry homes with straps or connectors.

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Hurricane straps may be difficult for homeowners to install. You may need to call a professional to retrofit your home with hurricane straps. Check with your local government building officials to see if hurricane straps are required in your area.



#### ***EXTERIOR DOORS AND WINDOWS***



The exterior walls, doors and windows are the protective shell of your home. If your home's protective shell is broken, high winds can enter and put pressure on your roof and walls, causing damage. You can protect your home by strengthening the doors and windows.

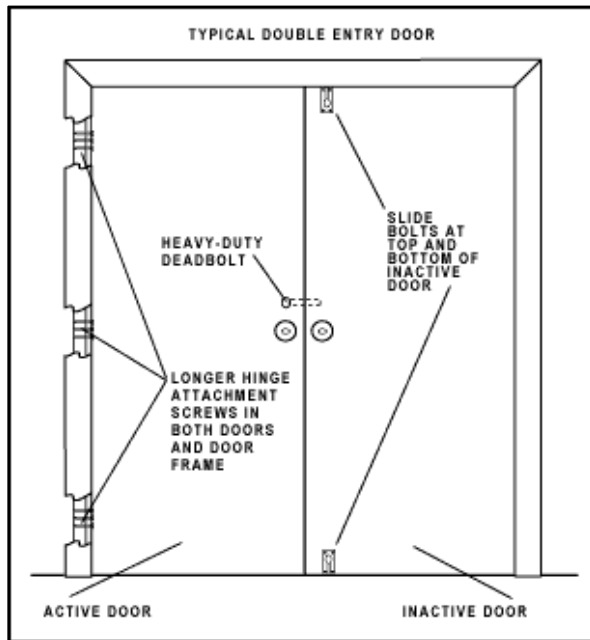
A common misunderstanding is that windows should be left open to equalize and stabilize pressure on our home. **The truth is that if hurricane winds enter any opening, damage is much more likely to occur due to increased internal pressure on walls and roofs supports. MAKE SURE ALL WINDOWS, DOORS AND OPENINGS ARE COMPLETELY COVERED AND BRACED.**



### ***REINFORCE DOUBLE ENTRY DOORS.***

Your home has either double or single entry doors. If they are solid wood or hollow metal they probably can resist wind pressures and hurricane debris. However, if you are not sure whether they are strong enough, take these precautions:

- Most double doors have an active and an inactive or fixed door. Check to see how the fixed door is secured at the top and bottom. Install head and foot bolts on the inactive door of double entry doors.
- Make sure your doors have at least three hinges and a dead bolt security lock which has a minimum 1-inch bolt throw length.
- Since double entry doors fail when their surface bolts break at the header trim or threshold, check the connections at both places. Be sure the surface bolt extends into the door header and through the threshold into the subfloor.

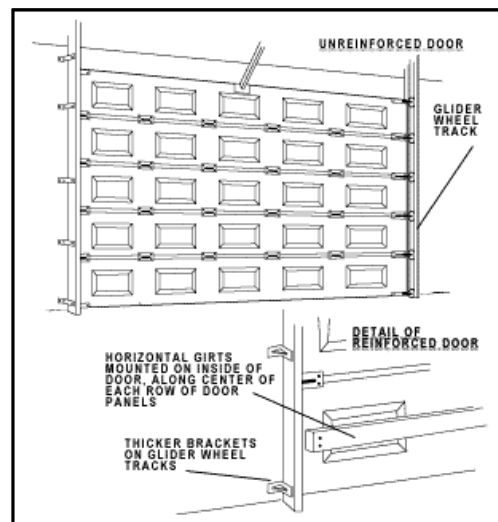


Some door manufacturers provide reinforcing bolt kits made specifically for their doors. Check with your local building supplies retailer to find out what type of bolt system will work for your door. The door bolt materials should cost from \$10 to \$40, depending on the type and finish. Doors with windows will need additional protection from flying debris.

### ***REINFORCE OR REPLACE GARAGE DOORS***

High winds from hurricanes and tornadoes can damage garage doors or even blow them in. If wind enters a garage it can cause dangerous and expensive structural damage. Reinforcing your garage door helps you protect not only your garage but its contents as well.

Because of their width, doublewide (two-car) garage doors can pose a problem during hurricanes because they are so large that they wobble as the high winds



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blow. Unless you have a tested hurricane resistant door, the wind may force it out of the roller track -- especially if the track is lightweight or some anchor bolts are not in place. This occurs because the door deflects too much under excessive wind pressure and fails. When garage doors fail, high winds can enter your home through the garage and blow out doors, windows, walls, and even the roof.

There are many steel, aluminum and wood bracing products on the market specifically made to withstand hurricane winds. If your garage door is not well-supported, you may want to investigate those products for future usage.

#### **To secure your garage door:**

- **Check with your local government building official to see if there are code requirements for garage doors in your area.** Certain parts of the country have building codes requiring garage doors to withstand high winds.
- Some garage doors can be strengthened with retrofit kits. **Check with your local building supplier or garage door retailer to see if a retrofit kit is available for your garage door.** You can expect to pay from \$75 to \$150 to retrofit your garage door.

You should probably reinforce your doublewide garage door at its weakest points. This involves installing horizontal and/or vertical bracing onto each panel, using wood or light gauge metal girts bolted to the door, added across the back of the door. This horizontal (or vertical) bracing can be part of a kit from the garage door manufacturer. You may also need heavier hinges and stronger center supports and end supports for your door. However, if your existing door is old or damaged, you might want to replace it with a stronger door and tracks. Even if you decide to buy a new door, reinforcing it is still a good idea. Hardware and home supply stores, as well as companies that specialize in overhead door sales and installation, can advise you about stronger doors and track systems.

To strengthen the glider wheel tracks, first check the track on your garage door. With both hands, grab a section of each track and see if it is loose or if it can be twisted. If so, a stronger track can be installed. Make sure that it is anchored to the 2x4s inside the wall with heavy wood bolts or properly attached to masonry with expansion bolts.

If you decide to retrofit your garage door with a kit that allows you to operate the door after it is installed, make sure the door is balanced by lowering it about halfway and letting go. If the door goes up or down, the springs will need adjusting. *Note: Since the springs are dangerous, only a professional should adjust them.*

If you are unable to retrofit your garage door with a kit *specifically designed for your door*, you can purchase garage door retrofit kits to withstand hurricane winds at your local building supply store. Also, check to see if the supplier can do the installation.



#### Tips

Keep these points in mind when you reinforce or replace your garage doors:

- Reinforcing an existing garage door is something you may be able to do yourself if you have the necessary skills and tools, or you can hire a contractor to do the work. The necessary materials, including metal brackets and wood boards for girts can usually be found at a lumber yard, hardware store, or home supply store.
- Single-car garage doors usually resist wind forces better than two-car garage doors.
- Don't wait until a hurricane warning is issued to reinforce your garage door; you probably won't have time.
- Installing a new garage door is more than a one-person job and is not the type of work that most homeowners who lack the necessary skills and equipment would want to undertake. If you buy a new door, you may want to either have the seller install it or hire a contractor.
- If you are buying a new door, get one without windows. Unless covered, glass is easily broken by high winds and windblown debris. Again, one reason for protecting your garage door is to prevent wind from entering the garage.

Estimated Cost. If you are unable to retrofit your door, you can purchase specially reinforced garage doors designed to withstand winds of up to 120 miles per hour. These doors can cost from \$400 to \$450 (excluding labor) and should be installed by a professional. If you hire a contractor to reinforce an existing two-car garage door, you can expect to pay about \$300. The cost of replacing a door, including installation, can vary greatly depending on the size and type of door.

## ***STORM SHUTTERS***

### ***INSTALL WINDOW/PATIO DOOR SHUTTERS***

Installing impact-resistant shutters over all exposed windows and other glass surfaces is one of the easiest and most effective ways to protect your home in windstorms. You should cover all windows, French doors, sliding glass doors, and skylights. Not only do they protect doors and windows from wind-borne objects, but they can reduce damage caused by sudden pressure changes when a window or door is broken. There are many types of manufactured shutters. Check with your local building supplies retailer. If you install manufactured shutters, follow the manufacturer's instructions carefully.

Before installing shutters, check with your local building official to find out if a building permit is required. It is important that you have your shutters ready now, and that you mark and store them so they can be easily installed during a hurricane watch.

The easiest designs are those that simply cover the opening with a structural panel such as plywood. Plywood shutters that you make yourself, if installed properly, can offer a high level of protection from flying debris during a hurricane. In past hurricanes, many homeowners upon returning have noticed their temporary plywood shutters blown off because they were not adequately fastened. If you have a wood-frame house, use adequate fasteners to attach panels over the openings when a hurricane approaches. If your home is made with concrete blocks, however, you will have to install anchoring devices well in advance.

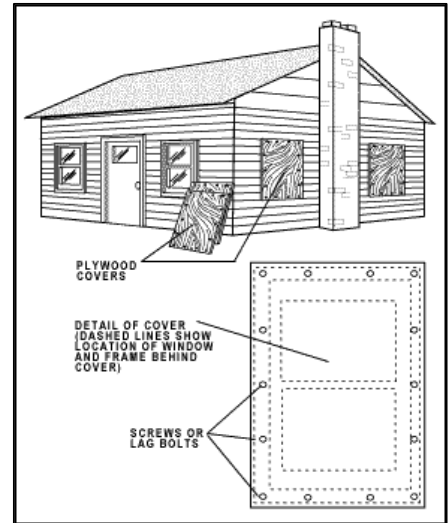
#### ***Steps to Installing Shutters***

1. Measure each window and each door that has glass, and add 8 inches to both the height and width to provide a 4-inch overlap on each side of the window or door. Sheets of plywood are generally 4x8 feet. Tell your local building supply retailer the size and number of openings you need to cover to determine how many sheets to buy.
2. To install plywood shutters you will need bolts, wood or masonry anchors, large washers, and 5/8-inch exterior-grade plywood. For windows 3 feet by 4 feet or smaller installed on a wood frame house, use 1/4-inch lag bolts and plastic-coated permanent anchors. The lag bolts should penetrate the wall and frame surrounding the window at least 1 3/4 inches.

For larger windows, use 3/8-inch lag bolts that penetrate the wall and frame surrounding the window at least 2 1/2 inches. For windows 3 feet by 4 feet or smaller installed on a masonry house, use 1/4-inch expansion bolts and

galvanized permanent expansion anchors. The expansion bolt should penetrate the wall at least 1½ inches. For larger windows, use 3/8-inch expansion bolts that penetrate the wall at least 1½ inches. The tools you will need are a circular or hand saw, a drill with the appropriately sized bits, a hammer, and a wrench to fit the bolts. To be safe, use eye protection and work gloves.

3. Cut the plywood to the measurements for each opening. Drill holes 2½ inches from the outside edge of the plywood at each corner and at 12-inch intervals. Drill four holes in the center area of the plywood to relieve pressure during a hurricane.
4. Place the plywood over the opening and mark each hole position on the outside wall. Drill holes with the appropriate size and type of bit for the anchors. Install the anchors, the plywood, and the bolts to make sure they fit properly. On wood-frame houses, make sure that the anchors are secured into the solid wood that frames the door or window and not into the siding or trim. Mark each shutter so you will know where it is to be installed and store them and the bolts in an accessible place.



If the opening is larger than one sheet of plywood, you will need to make shutters with 2x4 bracing. This bracing can be two 2x4s at the middle and bottom of the two sheets of plywood, evenly spaced, with the 2-inch side attached to the inside of the storm shutter. Attach the 2x4s to the outside of the storm shutter with 2-inch, 10-gauge wood screws before installing the shutter.

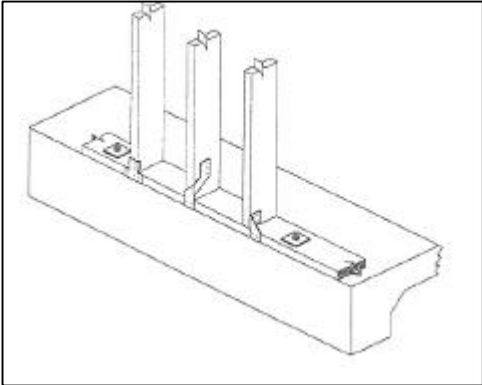
If your residence has permanent shutters, evaluate their effectiveness. Manufacturers are responsible for testing their shutters up to the standard necessary to resist wind forces and wind-borne debris. Some shutters are very flexible, especially those that roll up.

If struck by a rigid piece of debris, shutters may bend and break the window. To determine whether your shutter can resist this impact, gently lean against it and see if it yields. You can also inspect your shutters to see if they are properly attached to the house and will not fly off during a storm by inspecting the shutter connectors for obvious excessive wear or missing connectors. Ask the shutter manufacturer for proper installation criteria.

## **WALLS**

### ***REINFORCE WALL TO FOUNDATION CONNECTION***

To complete your home strengthening process, make sure the exterior walls are anchored to the foundation. Although this is not as critical as some of the other tasks listed here, an inadequate connection between the wall and foundation could weaken your entire home. This is especially true if you live in a one-story home with large roof truss spans and a low-sloped roof.



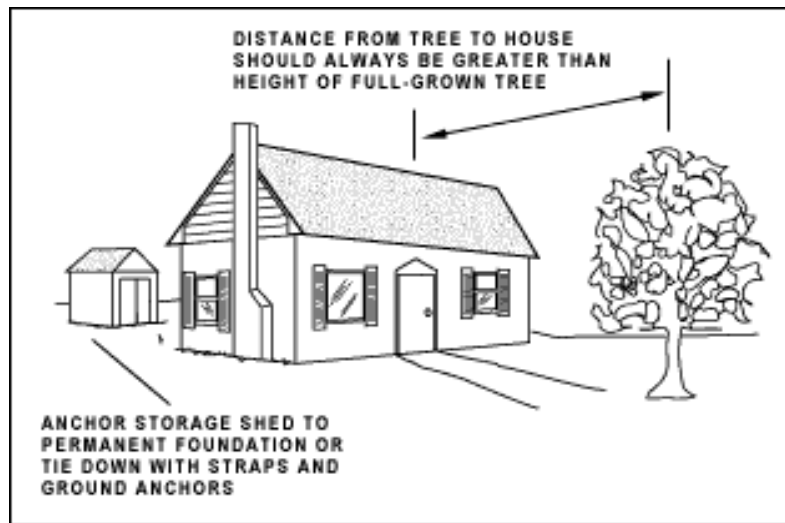
Make sure the wall studs are adequately connected to the sill plate, which sits directly on top of the foundation wall. Metal clips are available at your building supply store for this task. Then drill holes through the existing sill plate into the concrete foundation to install anchor bolts. Place the holes as close to the center of the sill plate as possible using epoxy anchors which you can find at your local building supply store.

An engineer should determine the minimum bolt spacing for the force analysis of the shear and uplift loads. But placing 5/8-inch diameter anchor bolts no more than 6 feet apart, with an anchor bolt at the end of each wall, provides an extra measure of safety for your home. Unfortunately, if you have a concrete masonry block home, verifying that the exterior wall is connected to the foundation is extremely difficult. In that case, the best method to make sure that all required reinforcing is present and installed correctly is to inspect for it while the home is being built.

## ***AREAS AROUND YOUR HOUSE***

### ***REMOVE TREES AND POTENTIAL WINDBORNE MISSILES***

If the area immediately surrounding your house contains trees, outbuildings, trashcans, yard debris, or other materials that can be moved by the wind, your house will be more likely to be damaged during a hurricane or tornado. The wind can topple trees onto your house and can pick up smaller objects and drive them through windows and glass doors.



You should ensure that all trees are far enough away from your house that they can't fall on it. So the distance between your house and any nearby tree should always be greater than the height the tree will reach when it is fully grown. All storage sheds and other outbuildings should be securely anchored, either to a permanent foundation or with straps and ground anchors. Smaller objects, such as trash cans, barbecue grills, and outdoor furniture should also be anchored or, if you have adequate warning, moved indoors. You should also clear away any debris, such as fallen tree branches.



### Tips

Keep these points in mind when you remove trees and potential windborne missiles from around your house:

- Removing large trees near your house can be extremely dangerous, for both you and your house, and therefore is a job for a skilled contractor.
- The straps and ground anchors used for manufactured homes also can be used to anchor outbuildings, especially small garden sheds, which are usually not placed on a permanent foundation.
- You can secure outdoor furniture and barbecue grills by bolting them to decks or patios or by attaching them to ground anchors with cables or chains. Also, with adequate warning, these can be moved indoors.
- You can secure trash cans with cables or chains attached to ground anchors or to wood posts firmly embedded in the ground. Trash can lids should be tied to cans with cables or chains.

Estimated Cost. If you hire a contractor to remove a large tree, you can expect to pay about \$300 to \$500. Having a contractor anchor a storage shed with straps and ground anchors will cost about \$100 to \$200.

## **PRE-HURRICANE/TORNADO MITIGATION TIPS**

- ❖ Gather outdoor furniture, garbage cans, potential debris, etc., and move them inside. Encourage your neighbors to do the same.
- ❖ Replace gravel/rock-landscaping material with shredded bark.
- ❖ When landscaping your home, use plant life that is native to hurricane areas, and more likely to stay rooted through winds and rains.
- ❖ Keep trees and shrubbery trimmed. Cut weak branches and trees that could fall or bump against the house. When trimming, try to create a channel through the foliage to the center of the tree to allow for airflow. Keep climbing roses and vines trimmed back. Do not attempt to do your trimming after a watch has been announced as trash pick will be delayed.
- ❖ Screened porches and other similar areas are usually first to suffer damage, so make sure the porch is properly attached. (*The industry has no standards yet for adequate performance of porch screens in hurricane winds.*)
- ❖ Reinforce the double-entry doors with heavy-duty foot and head bolts, and use a security dead bolt lock with 1-inch minimum bolt throw length.
- ❖ Reinforce the double garage door and tracks.
- ❖ If you find that the roof sheathing is not adequately attached:
  - use adhesive to attach the sheathing to the rafters
  - use extra 8d (8 penny nails or #8 screws) if you need to reroof
- ❖ Brace the gable end walls and roof trusses.
- ❖ Purchase materials to secure your home (plywood, shutters, plastic sheeting, nails, etc.). Cut and label plywood to fit all windows and sliding glass doors.



## SHELTERS FOR PROTECTION

The mitigation techniques provided in this unit are all good measures to help reduce damage to property caused by extreme winds. We realize that even with these measures implemented, the risks to life and property still remain. However, there is something you can do to reduce the number of lives lost. Residents of tornado- and hurricane-prone areas can now build a “safe room” or in-residence shelter that can protect against deadly tornadoes and hurricanes.

### ***What is a Safe Room?***

A safe room, or in-residence shelter, is a small windowless room, such as a closet or bathroom, readily accessible from all parts of the house, designed to provide occupant protection from tornadoes and hurricanes. Its purpose is threefold:

- To save lives,
- reduce injuries, and
- relieve anxiety.

The safe room is applicable to both existing residences and newly constructed homes. Included with this course is a publication, “***Taking Shelter from the Storm: Building a Safe Room Inside Your House***,” which outlines a room shelter design, including construction plans, materials and construction cost estimates.

The publication was developed by FEMA in collaboration with Texas Tech University’s Wind Engineering Research Center, Lubbock, Texas. Research shows that inspections done on homes in more than 90 towns and cities struck by tornadoes revealed that, in most cases, small rooms in the central portion of the house remained standing even when the house was severely damaged or completely destroyed. This led to the concept that these interior rooms could be economically reinforced to provide a high degree of occupant protection. A shelter built according to the plans can provide protection against winds of up to 250 miles per hour and projectiles traveling at 100 miles per hour. The estimated cost ranges from \$2,000 - \$6,000.

Read through the attached publication. If you live in an area vulnerable to tornadoes and hurricanes, we urge you to strongly consider constructing a safe room in your home. Remember: mitigate now – before the next windstorm – to save lives later.





## Unit Review

Circle the correct response. Answers may be found on page A1.

1. What can happen during a hurricane or tornado if your garage doors fail?
  - a) The car will be blown away.
  - b) High winds can enter your home through the garage and blow out doors, windows, walls, and even the roof.
  - c) Flying debris such as trees, lawn furniture, etc., can land in your garage.
  - d) Animals may use the garage as shelter from the windstorm.
2. Name one example of hurricane and tornado protection associated with the roof of the house.
  - a) Add bracing to gable end roof framing.
  - b) Determine what type of roof you have.
  - c) Inspect roof's bracing in the attic of the house.
  - d) Reinforce windows and doors.
3. The best time to do hurricane mitigation such as reinforcing the garage door or anchoring the walls to the foundation is:
  - a) When the hurricane warning is issued.
  - b) When the wind reaches 80 mph.
  - c) Now.
  - d) Anytime during hurricane season.
4. In getting your home ready for a hurricane, if your residence has permanent shutters...
  - a) no further work is necessary.
  - b) they have already been tested for wind resistance.
  - c) evaluate their effectiveness and replace if necessary.
  - d) they will not fly off during a storm.
5. Which of the following is ***not*** a pre-hurricane/tornado tip?
  - a) Make sure a screened porch is properly attached.
  - b) Reinforce the double-entry doors.
  - c) Gather outdoor furniture, garbage cans, potential debris, etc., and move them inside.
  - d) Open all windows and doors so the wind won't blow them in.
6. The National Weather Service issues this when the storm is possible in your area. You should remain alert for approaching storms. This is the time to remind family members where the safest places within your home are located, and listen to the radio or television for further developments. What is it?
  - a) Tornado sighting
  - b) Tornado warning
  - c) Tornado watch
  - d) Thunderstorm forecast